

Official Amendment

Serial No. - 10/625,885

Docket No. - UVD 0279 IA / UD 267

REMARKS

Claims 1, 3-77, and 79-104 were pending in the present application. Claims 1, 3, 13, 14, 46, 48, 77, 79, 85, and 97-104 have been amended, and new claims 105-106 have been added. As a result of this amendment, claims 1, 3-77, and 79-106 remain pending. Reexamination and reconsideration are requested in light of the accompanying amendments and remarks.

The rejection of claims 3, 79, and 85-90 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention has been overcome. Claim 3 has been amended to depend from claim 1, and claims 79, and 85 have been amended to depend from claim 77. Therefore, claims 3, 79, and 85-90 are in compliance with 35 U.S.C. § 112, second paragraph.

The rejection of claims 1, 3-77, and 79-104 under 33 U.S.C. § 102(b) as being anticipated by PCT publication WO 98/48075 (treated as equivalent to U.S. Patent No. 6,200,672 to Tadokoro) has been overcome. Tadokoro teaches "a surface treated metal sheet which is coated with a layer comprising as main components, a complex and/or salt between a rare earth metal element and an organic compound having in the molecule one or more functional groups selected from among -O-, =O, -OH, -COOH, -NH₂, -NH, =N-, -SH, -SO₃H and phosphoric groups, and a matrix which physically holds the above and has adhesive power for metal sheets, as well as a metal surface treatment solution used therefore." Abstract.

Although Tadokoro mentions the use of tetravalent cerium, it does not teach that "at least one rare earth element is in the tetravalent oxidation state in the rare earth/valence stabilizer complex," as in claims 1, 46, 77, and 102-104. The fact that tetravalent cerium is present in the starting solution, as shown in the Examples and Tables 1 and 2, does not mean it is present in the formed complex. Tetravalent cerium compounds in solution can easily form trivalent compounds in formed films. Tadokoro does not teach that its rare earth complex contains tetravalent cerium.

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Rare earth metal elements have anti-corrosion functions, although the mechanism thereof is not clear. *Any rare earth metal element* may be used in the rare earth metal complex (i.e. the complex and/or salt of the organic compound and rare earth element) used for the invention, and *there are no particular restrictions on the valency of the rare earth metal at the time the rare earth metal complex is formed*. Lanthanoids and/or yttrium are preferred from the standpoint of ease of handling, while from an economical standpoint, lanthanum or cerium is preferred, and tetravalent cerium which also has oxidizing power is even more preferred.

Col. 4, line 65 to col. 5, line 9.

In contrast, in the claimed invention, "at least one rare earth element is in the tetravalent oxidation state in the rare earth/valence stabilizer complex." The anticorrosion performance of coatings that contain complexes of trivalent rare earths and of tetravalent rare earths is notably different. With complexes containing trivalent rare earths, the formed coating is simply a barrier film which prevents corrosive species from reaching the metal. In the claimed invention which includes "at least one rare earth element is in the tetravalent oxidation state in the rare earth/valence stabilizer complex," the formed coating is an active inhibitor film, capable of self-healing breaches and scribes in the coating.

Furthermore, the action of the organic species in Tadokoro is different from that of the claimed invention.

Since such an organic compound adheres to metal surfaces, it can effectively supply the rare earth metal to the metal sheet surface and, even after dissociating from the rare earth metal element in the layer when corrosion proceeds, *it forms a complex with the dissolved metal component of the metal sheet and precipitates*, thus inhibiting further ionization of the metal sheet.

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Col. 6, lines 51-59. The valence stabilizers of the present invention are introduced to form stable tetravalent rare earth species in the *formed coating*. However, the organic species in Tadokoro are introduced such that *they bind with the metal ions supplied by the corroding metal itself*.

Furthermore, Tadokoro does not teach that the "rare earth/valence stabilizer complex has a solubility in water of between about 1×10^0 and about 1×10^{-5} moles per liter of cerium, terbium, or praseodymium at about 25°C and about 760 Torr," as in claims 1, 46, and 77, or that "the rare earth/valence stabilizer complex is sparingly soluble in water at about 25°C and about 760 Torr," as in claims 102-104. Tadokoro does not discuss the concept of "sparingly soluble" or the lower limit of solubility at a pH of 7. Tadokoro only discusses the lower limit of solubility at a pH of 3. See col. 5, lines 43-63. Tadokoro apparently assumed that even extremely low solubility rare earth compounds will be effective corrosion inhibiting compounds. In the case of an inactive barrier film (i.e., one that contains trivalent rare earths), it does not matter what the lower solubility limit is. However, as explained at p. 9, lines 14-16, and p. 21, lines 5-9, in the case of an active anticorrosive film (i.e., one containing tetravalent rare earths), once a lower solubility limit is reached, then insufficient anticorrosive compounds are available.

With respect to claims 3 and 79, Tadokoro does not teach "the solubility of the rare earth/valence stabilizer complex in water is between about 1×10^{-1} and about 1×10^{-4} moles per liter of cerium, terbium, or praseodymium at about 25°C and about 760 Torr," as claimed. As explained above, Tadokoro does not teach a lower limit for the solubility.

As to claims 6 and 82, Tadokoro does not teach that "the rare earth/valence stabilizer complex decomposes above about 100°C," as claimed. Tadokoro does not mention the decomposition temperature of the rare earth metal complex.

With respect to claims 7 and 83, Tadokoro does not teach that "the rare earth/valence stabilizer complex melts above about 50°C," as claimed. Tadokoro does not discuss the melting temperature of the rare earth metal complex.

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With respect to claims 8-9, Tadokoro does not teach that the "rare earth/valence stabilizer complex has a central cavity containing a cerium, praseodymium, or terbium ion and an additional ion." As discussed on p. 169, lines 1-15, the central cavity of the heteropolytungstates can contain an ion in addition to cerium. Examples include silicomolybdates, phosphomolybdates, silicotungstates, and phosphotungstates. In these complexes, the central cavity contains a Si^{+4} or P^{+5} ion in addition to the cerium ion. The molybdenum or tungsten is not in the central cavity; rather, it forms the central cavity. Tadokoro does not teach such an arrangement.

As to claims 11-12, Tadokoro does not teach an inorganic valence stabilizer. According to the examiner, "[a]t col. 9, line 26 to col. 10, line 9 of Tadokoro et al., the reference discusses employing oxyacid compounds of the rare earth metal elements (which encompasses compounds formed between anions such as phosphate, tungstate, vanadate, etc., with rare earth metals) to form inorganic based corrosion resistance chemical treatment layers." Todokoro's layer includes two components: a complex and/or salt between a rare earth metal element and an organic compound, and a matrix which physically holds the rare earth metal complex and has adhesive power for metal sheets. The discussion at col. 9, line 26 to col. 10, line 9 relates to the matrix, not the rare earth metal complex.

With respect to claims 31-33, Todokoro does not teach that the "solubility in water of the rare earth/valence stabilizer complex is adjusted by an addition of a substituent group on the organic valence stabilizer," as claimed. Nor does it teach increasing or decreasing the solubility using the specific groups claims 32 and 33.

As to claims 34-35, Tadokoro does not teach that the "electrostatic barrier layer of the rare earth/valence stabilizer complex is adjusted by an addition of a substituent group on the organic valence stabilizer," as claimed, or the specific substituent groups of claim 35.

With respect to claims 36-41, 62-72, and 85-90, Tadokoro does not teach the use of solubility control agents, nor does it teach the specific ones in claims 38-41, 64-67, and 87-90.

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As to claims 42, 76, and 91, Tadokoro does not teach that "the rare earth/valence stabilizer complex is adsorbed or mixed onto, into, or with an inert medium selected from oxides, hydroxides, phosphates, borates, silicates, carbonates, aluminates, titanates, molybdates, tungstates, oxalates, polymers, or combinations thereof," as claimed.

With respect to claims 43-45 and 92-94, Tadokoro does not teach that "the pigment is colored," that "the pigment exhibits a color change between trivalent and tetravalent oxidation states," or that "the pigment is light-fast," as claimed.

With respect to claims 48-52, Tadokoro does not teach "oxidizing the rare earth source to obtain the at least one rare earth source in the tetravalent oxidation state," or the methods and oxidizers claimed.

Therefore, claims 1, 3-77, and 79-104 are not anticipated by Tadokoro.

The rejection of claims 1, 3-77, and 79-104 under 33 U.S.C. § 102(b) as being anticipated by DePue (U.S. Patent No. 5,322,560) has been overcome. DePue teaches a corrosion inhibitor compound for treating aluminum flake pigment. The corrosion inhibitor compound is the reaction product of a water-soluble metal salt including metals selected from the group consisting of yttrium and rare earth metals and an anionic metal salt including transition metal oxo-complexes and soluble salts of silicon and mixtures thereof. Abstract.

According to the examiner, DePue teaches a "corrosion inhibitor that is the reaction product of a water-soluble metal salt (including metals selected from yttrium and rare earth metals) and an anionic metal salt including transition metal oxo-complexes and soluble salts of silicon and mixtures thereof. See the Abstract of DePue et al., as well as col. 2, lines 27-36, in which DePue et al. disclose titanium, vanadium, chromium, zirconium, niobium, molybdenum, hafnium, tantalum, tungsten, and mixtures thereof as exemplary transition metals (see also col. 3, lines 1-22 of DePue et al., which also discloses that the inhibitor is "slightly water-soluble", defined as no more than 10^{-3} molar concentration in a saturated aqueous solution. The corrosion

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inhibitors are useful when used in combination with water-soluble salts of yttrium, cerium, and tetravalent cerium."

DePue does not teach that "at least one rare earth element is in the tetravalent oxidation state in the rare earth/valence stabilizer complex," as in claims 1, 46, 77, and 102-104. DePue's corrosion inhibitors are the "reaction product of water-soluble compounds including yttrium, lanthanum, or rare earth metals of the lanthanide series (i.e. atomic numbers of from 58 to 71) and an anionic metal complex including a soluble salt of silicon or of transition metal oxo-complexes . . ." Col. 2, lines 27-32. The oxidation state of the rare earth metal in the compound is not discussed.

The only tetravalent cerium compounds described in DePue are *salts*, not *rare earth/valence stabilizer complexes*, as claimed.

The corrosion inhibitors of the present invention are also useful when used in combination with water-soluble *metal salts of yttrium and the rare earth metals*.

Particularly useful *salts include trivalent cerium, yttrium and lanthanum salts and tetravalent cerium salts*.

Col. 2, lines 56-60. These salts are discussed further at col. 4, lines 34-55.

The slightly soluble corrosion inhibitor of the present invention is also useful in aqueous coating compositions containing aluminum flake pigment. The corrosion inhibitor is particularly effective in coating compositions when used as a secondary corrosion inhibitor in combination with a primary corrosion inhibitor which is a water-soluble *salt of trivalent or tetravalent salt of cerium, yttrium or lanthanum*. Water-soluble salts useful as a primary corrosion inhibitor compound for treating the aluminum pigment include cerium sulfate, cerium triacetate, cerium isopropoxide, ammonium cerium nitrate, yttrium triacetate, lanthanum triacetate and cerium nitrate.

When used in combination in a coating composition, *the water soluble metal salt used as the primary corrosion inhibitor* is present in an amount of between 0.01% and

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5.0% by weight based on total pigment weight and *the slightly soluble salt used as the secondary corrosion inhibitor* is used in an amount between 0.01% and 5.0% by weight based on the combined weight of the corrosion inhibitor and pigment.

These salts are highly soluble in water, and fall above the solubility parameters specified in the claims. In fact, several of the salts mentioned are identified in the application as being suitable cerium sources: cerium sulfate, cerium triacetate, ammonium cerium nitrate and cerium nitrate. See p. 13, line 23 to p. 14, line 12.

In addition, the action of DePue's corrosion inhibitor is different from that of the claimed invention. Most of the time, DePue's corrosion inhibitor is unreacted in the form of a precipitate due to its relatively insoluble nature. It provides an additional source of rare earth metal to form a metal oxide protective coating at any site left unprotected by the metal oxide film provided by the more soluble trivalent and tetravalent salts of the primary corrosion inhibitor. Col. 4, line 56 to col. 5, line 9. The valence stabilizers of the present invention are introduced to form stable tetravalent rare earth species in the *formed coating*.

Furthermore, DePue does not teach that the "rare earth/valence stabilizer complex has a solubility in water of between about 1×10^0 and about 1×10^{-5} moles per liter of cerium, terbium, or praseodymium at about 25°C and about 760 Torr," as in claims 1, 46, and 77, or that "the rare earth/valence stabilizer complex is sparingly soluble in water at about 25°C and about 760 Torr," as in claims 102-104. DePue does not discuss the concept of "sparingly soluble" or the lower limit of solubility at a pH of about 7. See col. 3, lines 1-6. DePue apparently assumed that even extremely low solubility rare earth compounds will be effective corrosion inhibiting compounds. In the case of an inactive barrier film (i.e., one that contains trivalent rare earths), it does not matter what the lower solubility limit is. However, as explained at p. 9, line 14-16, and p. 21, lines 5-9, in the case of an active anticorrosive film (i.e., one containing tetravalent rare earths), once a lower solubility limit is reached, then insufficient anticorrosive compounds are available.

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With respect to claims 3 and 79, DePue does not teach "the solubility of the rare earth/valence stabilizer complex in water is between about 1×10^{-1} and about 1×10^{-4} moles per liter of cerium, terbium, or praseodymium at about 25°C and about 760 Torr," as claimed. As explained above, DePue does not teach a lower limit for the solubility.

As to claims 6 and 82, DePue does not teach that "the rare earth/valence stabilizer complex decomposes above about 100°C," as claimed. DePue does not mention the decomposition temperature of the corrosion inhibitor.

With respect to claims 7 and 83, DePue does not teach that "the rare earth/valence stabilizer complex melts above about 50°C," as claimed. DePue does not discuss the melting temperature of the corrosion inhibitor.

With respect to claims 8-9, DePue does not teach that the "rare earth/valence stabilizer complex has a central cavity containing a cerium, praseodymium, or terbium ion and an additional ion." As discussed on p. 169, lines 1-15, the central cavity of the heteropolymetallates can contain an ion in addition to cerium. Examples include silicomolybdates, phosphomolybdates, silicotungstates, and phosphotungstates. In these complexes, the central cavity contains a Si^{+4} or P^{+5} ion in addition to the cerium ion. The molybdenum or tungsten is not in the central cavity; rather, it forms the central cavity. DePue does not teach such an arrangement.

With respect to claims 13-30, DePue does not teach any organic valence stabilizers, nor does it teach those specified in claims 13-30.

With respect to claims 31-33, DePue does not teach that the "solubility in water of the rare earth/valence stabilizer complex is adjusted by an addition of a substituent group on the organic valence stabilizer," as claimed. Nor does it teach increasing or decreasing the solubility using the specific groups claims 32 and 33.

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As to claims 34-35, DePue does not teach that the "electrostatic barrier layer of the rare earth/valence stabilizer complex is adjusted by an addition of a substituent group on the organic valence stabilizer," as claimed, or the specific substituent groups of claim 35.

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As to claims 42, 76, and 91, DePue does not teach that "the rare earth/valence stabilizer complex is adsorbed or mixed onto, into, or with an inert medium selected from oxides, hydroxides, phosphates, borates, silicates, carbonates, aluminates, titanates, molybdates, tungstates, oxalates, polymers, or combinations thereof," as claimed.

With respect to claims 43-45 and 92-94, DePue does not teach that "the pigment is colored," that "the pigment exhibits a color change between trivalent and tetravalent oxidation states," or that "the pigment is light-fast," as claimed.

With respect to claims 48-52, DePue does not teach "oxidizing the rare earth source to obtain the at least one rare earth source in the tetravalent oxidation state," or the methods and oxidizers claimed.

Therefore, claims 1, 3-77, and 79-104 are not anticipated by DePuc.

CONCLUSION

Applicants respectfully submit that, in view of the above amendment and remarks, the application is now in condition for allowance. Applicants respectfully request that claims 1, 3-77, and 79-106 be passed to allowance.

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If the Examiner has any questions or comments regarding the present application, he is invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,
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